by C. Müller and Kindberg, while three are relegated to the doubtful list, and two to the rank of varieties. *Brachythecium asperrimum* holds the record with *four* Kindbergian names as synonyms! Let the good work go on.—C R. B.

AT THE TIME of the death of Dr. Schröter, December, 1894, the *Pilze* of the *Kryptogamen-Flora von Schliesen* was within three parts of completeness. Part of the manuscript for the remainder was prepared, but about one signature had not been begun. The publishers have now issued one of the remaining parts[5] which carries the work through the *fungi perfecti*, and through eighty-five species of the *fungi imperfecti*, which is all the material the author left in readiness for the press.

The publishers express regret that they have been unable to secure a suitable person to complete the work upon the original lines. They therefore purpose to issue shortly a final part, to contain such species as Schröter had indicated, as shown by his fragmentary notes and the herbarium deposited in the Pflanzenphysiologisches Institut of the University of Breslau. It will also contain a supplement giving Schröter's changes and additions to the preceding parts, and will close with an index to the second volume.—J. C. A.

NOTES FOR STUDENTS.

FRIEDRICH OLTMANNS[6] has described the results of a recent study of the swarm spores of certain Phæophyceæ. He claims to have disproved the statements of Berthold,[7] as quoted in the standard texts, that in *Ectocarpus siliculosus* a large zoospore comes to rest, becomes attached to one to four small zoospores, and then fuses with them; also that zoospores from plurilocular sporangia fuse in pairs. The form most fully studied was *E. criniger*, in which unilocular sporangia, if present, were not discovered. The claim is that one is dealing here, not with a primitive condition of sexuality, but rather with infusorians which are eating the algal zoospores. The number of nuclei in the so-called zygote is invariably one greater than the number of chromatophores, and the extra nucleus differs from the others in appearance and staining reactions. The process of digestion of the spores can be followed, and the wastes are ejected as minute balls. These facts point to the infusorial nature of the larger organism. This conclusion does not deny all

[5] SCHRÖTER, J.—Kryptogamen-Flora von Schliesen, Dritter Band: Pilze. Zweite Hälfte, vierte Lieferung. 8vo. pp. 385–500. Breslau: J. U. Kern's Verlag. 1897. *M* 3.20.

[6] Ueber Scheincopulationen bei Ectocarpeen und anderen Algen. Flora **83**: 398–414. 1897.

[7] Die geschlechtliche Fortpflanzung der eigentlichen Phaeosporeen. Mitth. d. zool. Stat. Neapel **2**: 401. 1897.

sexual fusions among the spores of Algæ, but may explain many "abnormal" processes, such as the fusion of three or four zoospores in Acetabularia, etc. Many appearances in Dasycladus are due to abortions, the protoplasm having emerged from the mother cell before the zoospores are perfectly formed.

The author believes that Berthold saw nothing but the activity of infusorians, and confirms his views by drawings from some of Berthold's preparations. The fusion of nuclei in the zygote is nowhere seen. That Berthold found zygotes in only a part of his cultures, that he had so many female and so few male zoospores, and that his zygotes never germinated, all go to prove that the bodies were really infusorians. Oltmanns obtains his best results in cultures from three to four days old, those younger not giving the infusorians time to come into sufficient prominence. One can but regret that so important a paper should be accompanied by drawings so small as to make it difficult to distinguish chromatophore from nucleus, to say nothing of telling a zoospore nucleus from that of an infusorian.

Berthold's reply[8] immediately follows. Since Thuret, no one has denied that spores from plurilocular sporangia could germinate without fusion. Oltmanns did not see the sexually formed spores at all, and what he describes as Chytrideæ were described by Berthold in 1881 as products of the disorganization of male zoospores. The genuine zygotes are formed very soon after the spores are formed, and if formed at all are exceedingly numerous. Fusion of more than two zoospores is very rare. The existence of the extra (infusorian) nucleus is to be doubted. A series of memoranda, made while studying the living material, shows how some cultures could be recognized as composed of male, others of female zoospores, and still others of neutral spores capable of direct germination. From one lot of zygotes plants with plurilocular sporangia were finally obtained. Spores of one culture were nearly all alike; and cultures of male and female zoospores when mixed gave zygotes in the greatest number.

We agree with the two authors that little more is to be learned from mere discussion. Such directly conflicting statements can only be reconciled by further investigation.—W. D. M.

DR. C. O. TOWNSEND[9] has further investigated the relation of the nucleus to cell wall formations in a large series of plant cells. He finds that in every case the presence of a nucleus is necessary to enable a mass of protoplasm to enclose itself with a wall. This influence of the nucleus, however, can be transmitted to considerable distances between parts of the same cell separated

[8] Bemerkungen zu der vorstehenden Abhandlung von Fr. Oltmanns. Flora 83: 415–425. 1897.

[9] Der Einfluss des Zellkerns auf die Bildung der Zellhaut. Inaug. Diss. Jahrb. f. wiss. Bot. 30: —. 1897. [Heft. 4.]

by plasmolysis, and from one cell to another, provided only that protoplasmic continuity through living fibers is maintained. The author believes that Palla's failure to observe such fine connecting fibers between plasmolyzed masses in pollen tubes led to his erroneous conclusion that the nucleus is not necessary to cell wall formation. Very interesting is the fact that mere contact between two plasma masses is not sufficient for the transmission of the formative influence of the nucleus from one to the other. Just what this rôle of the nucleus is in cell wall formation the author does not attempt to state.—R. A. H.

DR. C. ISHIKAWA of the Imperial University, Tokyo, Japan, has published a third paper[10] in his series of "Studies of reproductive elements." It treats of the pollen grains of *Allium fistulosum*, with special reference to the process of chromosome reduction. In this process he finds some important deviations from what has hitherto been regarded as typical of flowering plants. Although he did not succeed in observing the original delimitation of the sporogenous region from the ordinary tissue of the anthers, he obtained very young sporogenous cells in stamens which were just making their appearance as protuberances on the flower disk. In these early sporogeneous cells the nuclei were already distinguishable by poverty of chromatin, and in division showed the reduced number (eight) of chromosomes, the division being described as heterotypic. The chromosomes split longitudinally, and the segments during metakinesis remain attached by their ends so as to form rings. In the pollen mother cell the spirem is apparently one continuous ribbon, which, after a synapsis stage, becomes divided into segments having the chromatin granules arranged in double rows. The segments shorten and become sharply bent at the middle. Longitudinal fission is now complete, and the bent segments attaching themselves together in pairs at the point of bending give rise to eight X-shaped figures which resemble the tetrads of some animals. Metakinesis proceeds according to the heterotypic method. Arriving at the poles of the spindle, the eight V-shaped daughter chromosomes break transversely at the angle, and form sixteen rod-shaped granddaughter chromosomes. No complete resting condition ensues, but division of the pollen daughter cell into the pollen grains follows at once, according to the heterotypic method. The next stage, the formation of the vegetative and generative nuclei, presents no unusual phenomena. It may be added that in the first division of the pollen mother cell bodies resembling centrosomes were frequently observed.

Doubtless the most interesting observation in this account of spermatogenesis is the early reduction of the number of chromosomes. In all other flowering plants in which chromosome reduction has been investigated it is

[10] Die Entwicklung der Pollen-Körner von *Allium fistulosum* L., ein Beitrag zur Chromosomen Reduktion im Pflanzenreiche. Jour. Coll. Sci. (Tokyo) **10**:—.

said to take place in the pollen mother cell. So it has been described for *Lilium Martagon* by Strasburger, Guignard, Farmer, and Miss Sargant; also for *Larix Europæa* and other plants. In all these cases, too, the chromosomes are distributed by means of two longitudinal fissions; while in *Allium fistulosum* their distribution in the second division of the pollen mother cell is effected by transverse fission. It will be noted that in so far as the reduction in *Allium fistulosum* deviates from the ordinary plant type it approaches what has been reported in certain animals, especially in some copepods and Gryllotalpa, where the second division of the spermatocytes is attended by transverse splitting of the chromosomes, and the reduced number of chromosomes appears early, even as early in *Cyclops brevicornis*, according to Haecker, as the primordial cells of the blastula stage.

Transverse fission of chromosomes in plants has been reported by Calkins in Pteris and Adiantum, by Mottier in Lilium, and by Schaffner in *Lilium Philadelphicum*.—W. R. S.